APPENDIX A

SUMMARY OF PROPOSED MODIFICATIONS AND CLARIFICATIONS TO EXISTING REGULATORY REQUIREMENTS

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In reviewing the low-emission vehicle regulations, staff has identified several areas where updates and revisions are needed. The following summarizes the proposed regulatory modifications and includes the proposed regulatory text to be considered in this rulemaking. In some instances, the modifications are editorial corrections of typographical errors or changes which conform the texts of various test procedures. There are also several changes that have no regulatory effect but simply serve to streamline text to provide greater clarity.

A. Section 1960.1. Exhaust Emission Standards and Test Procedures - 1981 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles

1. In addition to the proposed medium-duty vehicle regulatory modifications described in section IV of the staff report, staff is proposing the following substantive modifications.

a. **Section (e)(3)**. Add a new medium-duty vehicle category to the formaldehyde requirements - SLEV. The SLEV requirements are 50% lower than ULEV levels.

b. **Sections (g)(1) note (6)**. Staff is proposing to extend the intermediate in-use compliance standards (which currently end in 1998) for light-duty LEVs through the 1999 model year and through the 2002 model year for ULEVs. Since manufacturers will likely not be introducing LEVs until 1998 and ULEVs until 2001, this will allow them additional flexibility is developing the necessary technology needed to meet LEV and ULEV levels. In addition, staff is proposing a 100,000 mile intermediate in-use standard beginning with the 1999 model year.

> "The following standards ~~in parentheses~~ are intermediate in-use compliance standards for 50,000 miles and 100,000 miles f~~F~~or PCs and LDTs from 0-5750 lbs. LVW, including fuel-flexible and dual-fuel vehicles when operating on an available fuel other than gasoline. ~~,~~ I~~i~~ntermediate in-use compliance standards shall apply to TLEVs through the 1995 model year as follows: ~~, and to LEVs and ULEVs through the 1998 model year~~.
>
> | | NMOG (g/mi) |
> |---|---|
> | PCs and LDTs 0-3750 lbs. LVW | 0.188 |
> | LDTs 3751 - 5750 lbs. LVW | 0.238 |
>
> In-use compliance with standards beyond 50,000 miles shall be waived through the 1995 model year for TLEVs, and through the 1998 model year for LEVs and ULEVs. For LEVs and ULEVs, the following intermediate in-use standards shall apply:

Vehicle Type	Durability Vehicle Basis (mi)	LEV			ULEV			
		Model Year	NMOG (g/mi)	NOx (g/mi)	Model Year	NMOG (g/mi)	CO (g/mi)	NOx (g/mi)
PCs, 0-3750 lb. LVW LDTs	50,000	through 1998	0.100	0.3	through 1998	0.058	2.6	0.3
	50,000	1999	0.090	0.3	1999-2002	0.055	2.1	0.3
	100,000		0.125	0.4	1999-2002	0.075	3.4	0.4
3751-5750 lb. LVW LDTs	50,000	through 1998	0.128	0.5	through 1998	0.075	3.3	0.5
	50,000	1999	0.130	0.5	1999-2002	0.070	2.8	0.5
	100,000		0.160	0.7	1999-2002	0.100	4.4	0.7

c. **Section (g)(1) note (7).** Revise the particulate standard for light-duty trucks from 3751-5750 lbs. LVW to align with the particulate standards for medium-duty vehicles in the same weight class (e.g., for LEVs the standard would increase from 0.08 to 0.10 and for ULEVs from 0.04 to 0.05).

d. **Section (g)(2) note (7)e., and (h)(2) note (12)g.** Add language to require manufacturers to submit fleet average and credit calculations by March 1 of the calendar year following the close of the model year in order to confirm the accrual of emission credits or debits. This requirement will ensure that the calculations made by the ARB are in agreement with the calculations made by manufacturers in the development of NMOG, ZEV and medium-duty vehicle equivalent credits and/or debits.

2. Staff is also proposing the following non-substantive modifications.

a. **Section (g)(1); (g)(2); (h)(2)**. Headings and subtitles have been added for clarification, e.g., section (g)(1) note (3) and (4):

(3) *Compliance with NMOG Standard*. or
(4) *Standards for Fuel-Flexible and Dual-Fuel Vehicles*.

b. **Section (g)(1) note (1), (g)(2) note (1), (h)(2) note (1)**. The following abbreviations and definitions have been combined under one footnote section in order to avoid redefining the terms which appear later in the text.

In (g)(1) note (1):
"LVW" means loaded vehicle weight (This language was removed from note (3)b.)
"Non-Methane Organic Gases" or "NMOG" means the total mass of oxygenated and non-oxygenated hydrocarbon emissions. (Note: this language was moved from footnote (3).)
In (g)(2) note (1):
"TLEV" means transitional low-emission vehicle
"LEV" means low-emission vehicle

"ULEV" means ultra-low-emission vehicle (The abbreviations of TLEV, LEV and ULEV were removed from (g)(2) note (4) and placed in this definition section.)

"LVW" means loaded vehicle weight (This language was removed from note (4).)

In (h)(2) note (1):

"Non-Methane Organic Gases or "NMOG" means the total mass of oxygenated and non-oxygenated hydrocarbon emissions. (Note: this language was moved from note (3).)

c. **Section (g)(1) note (3); (h)(2) note (3); (k)**. Replace last amended date with new amended date.

Sections (g)(1) and (h)(2):

"... "California Non-Methane Organic Gas Test Procedures" as adopted July 12, 1991, and last amended, ~~September 22, 1993~~_____ which is incorporated herein by reference.

Section (k):

"... adopted by the state board on May 20, 1987, as last amended ~~September 22, 1993~~ _____ both of which ..."

d. **Section (g)(1) notes (4)b and (6)b; (h)(2) notes (4)b. and (9)b**. The requirements for fuel-flexible and dual-fuel vehicles operating on gasoline have not changed, but the language has been placed in a table for ease of reference.

e. **Section (h)(1) note (2)**. The reference to section 1956.8(e) Title 13, CCR, is incorrect; it should be 1956.8(g).

f. **Section (h)(2) note (9)a**. The language in this section has been modified to conform with the language in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."

"... than gasoline, NMOG exhaust mass emission results shall be multiplied by the applicable reactivity adjustment factor to determine compliance with the intermediate in-use compliance standards for NMOG. ... multiplying the exhaust NMOG mass emission results ~~levels~~ by the applicable reactivity ... methane mass emission results ~~level~~ by the ..."

g. **Section (h)(2) note (10)c**. The language in this section has been added to conform with the language in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."

B. CCR, Title 13, Section 1956.8. Exhaust Emission Standards and Test Procedures - 1985 and Subsequent Model Heavy-Duty Engines and Vehicles

1. A complete description of the proposed medium-duty vehicle regulatory modifications affecting sections (c) and (h) is contained in Section IV of the staff report.

2. **Section (h) note B**. A new emission category, "SLEV," or super low-emission vehicle, is defined in note B. A complete description of this new emission category is contained section IV of the staff report.

C. California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles.

1. **Headings and subtitles** have been added in some sections for clarification and ease of reference. In addition the use of **boldface** type has been used to further simplify topical references.

2. **Table of Contents**: No Change.

3. **Section** 1, General Applicability: No Change.

4. **Section 2**, Definitions. The entire list of definitions has been alphabetized. In addition the term being defined is now in boldface type. Several new definitions have been added as well:

"**Loaded Vehicle Weight**" or "**LVW**" means the vehicle curb weight plus 300 pounds.
"**Super Low-Emission Vehicle**" or "**SLEV**" means any medium-duty vehicle certified to the super-low emission vehicle standards.

The following definitions have been amended:
"**Diesel Engine**" means any engine powered with diesel fuel, gaseous fuel, ~~ethanol, or methanol~~ or alcohol fuel for which diesel engine speed/torque characteristics and vehicle applications are retained.
"**Non-methane organic gas**" or "**NMOG**" means ... and last amended ~~September 22, 1993~~ _____.

5. **Section 3**. Changes identical to those proposed in Title 13, 1960.1 have been made to section 3 of the test procedures. In addition, section 3.h. note (4)c. has been amended to conform to the language in section 1960.1(g)(2) note (4)c.

"c. Beginning with the 1996 model year, manufacturers that produce and deliver for sale in California PCs and LDTs 0-3750 lbs. LVW..."

6. **Section 4.a.3.(vii)**: The application for certification is currently required to include a description of the control system logic of the fuel fired heater. However, in order to fully evaluate the fuel fired heater, it is also necessary to examine the exhaust emissions of that heater when operating at maximum heating capacity. It is not expected that fuel fired heaters will produce excessive exhaust emissions but this requirement will enable the ARB to monitor the fuel fired heater technology. Therefore, it is being proposed that the following paragraph be added to the requirements for the certification application:

> "For ZEVs and HEVs which use fuel fired heaters, the manufacturer shall provide the exhaust emissions value per mile produced by the auxiliary fuel fired heater. This shall be accomplished by determining heater emissions in grams per minute when operating at a maximum heating capacity, and multiplying that number by 3.6 minutes per mile. At the time of certification, manufacturers shall submit their test plan which describes the procedure used to determine the mass emissions of the fuel fired heater."

7. **Section 4.c.2., and 6.b.5**. Change reference to 4.b.4. to 4.c.5. In a previous amendment to these test procedures, subparagraph 4.b.4 became 4.c.5. However, the references to this subparagraph in section 4.c.2 and 6.b.5 were not updated. This modification correctly identifies the appropriate subparagraph.

8. **Section 5.a.2(i)(B)(8)**. Add paragraph which requires manufacturers of hybrid electric vehicles which use diesel engines to maintain the hybrid electric vehicle battery system in the same manner as required of hybrid electric vehicles which use otto-cycle engines. This requirement was inadvertently omitted in the previous rulemaking.

> (8) Hybrid electric vehicle battery system. Manufacturers shall maintain the battery system according to the requirements in section 5.a.(2)(i)(A)(10) of these test procedures.

9. **Section 6.b.5**. See C.4 above for description of modification.

10. **Sections 7. and 8**. [No Change]

11. **Section 9.f.(2)** The reference to the Urban Dynamometer Driving Schedule is incorrect. It should be Part 86 rather than Part 600.

12. **Section 10**. [No Change]

13. **Section 11.f**. Add reference to CCR, Title 13, Section 1968.1 to reflect the current on-board diagnostic regulations.

"... For all vehicles subject to the provisions of Section 1968 or 1968.1, Title 13, ~~California Code of Regulations~~ CCR, the manufacturer shall submit with its .... with the requirements of Section 1968 or 1968.1)."

14. **Section 11.k**. Testing conducted by the ARB demonstrated that at 50°F, the emissions of a ULEV-capable vehicle were approximately double the value at higher temperatures. Therefore, staff is proposing to change to the 50°F multiplier for ULEVs from 1.0 to 2.0.

".... For all ULEVs, emissions of NMOG and formaldehyde at 50°F shall not exceed the 50,000 mile certification standard multiplied by a factor of ~~1.0~~ 2.0.

15. **Section 12**. [No Change]

16. **Section 13.** See description of proposed reactivity adjustment factors contained in the staff report.

17. **Section 14**. [No Change]

18. **Appendices I through VII**. [No Change]

19. **Appendix VIII**: Staff is proposing that the list of compounds contained in these test procedures be conformed with the list of compounds contained in Appendix I of the California Non-Methane Organic Gas Test Procedures. A complete description of this change is described in below with the California Non-Methane Organic Gas Test Procedures.

D. California Exhaust Emission Standards and Test Procedures for 1987 and Subsequent Model Heavy-Duty Otto-Cycle Engines and Vehicles

The proposed revisions to these test procedures relate to the changes being proposed for medium-duty vehicles. Modifications identical to those proposed in Title 13, CCR, section 1956.8 are being proposed in these test procedures.

E. California Non-Methane Organic Gas Test Procedures

1. In reviewing these test procedures, staff identified several areas where text was duplicated unnecessarily. For example, Attachment 1, which used to be appended to both Method 1002 and Method 1003, contains the same list of compounds. Rather than repeat the list, Attachment 1 was moved to Appendix I. There were also several instances in each method where previously defined text or acronyms were redefined. For this reason, Appendix 2 contains a

complete list of abbreviations and definitions. Finally, all the references contained at the end of each method have been moved to Appendix 3.

2. Editorial corrections were also made to correct typographical or grammatical errors. The majority of the grammatical revisions simply clarify vague or repetitive text. In some instances, text that appeared in several of the methods was conformed where necessary. All other non-substantive changes are listed below.

a.. Part A.2.: include Appendix 1, 2 and 3 in the applicability of the test procedures.

b. Part B. :

a. 5.2.3: Add CO_e factor for Phase 2 gasoline and CNG and update factors for LPG. The carbon to hydrogen ratio for Phase 2 gasoline is based on the average of the ARB's analysis and AAMA's analysis of two separate batches of fuel supplied by different producers. The carbon to hydrogen ratios for CNG and LPG are now based on the certification fuel specification rather than on an individual batch of fuel. Manufacturers are not prohibited from developing ratios based on actual batches of fuel; however, due to resource constraints, the ARB uses an "idealized" ratio.

b. 5.2.4: Add DF for Phase 2 gasoline and CNG; update DF for LPG. See description in 4.a.

3. The following modifications pertain only to Parts C through F of the NMOG Test Procedures, which set forth the laboratory methods for the measurement of alcohols, hydrocarbons and carbonyl compounds. Since some modifications apply to each of Part C, D, E, and F, they are described by topic below. Modifications which apply to individual methods will be discussed by method below.

a. **Frequency of Multipoint Calculations**. When the methods were first developed and implemented, it was necessary to verify the linearity of the instrumentation at regular intervals. However, subsequent testing has verified that the instrument linearity tends to remain stable for long periods of time, unless certain types of modifications are made to the instruments. Based on these test results, staff is proposing that multipoint calibrations be performed only if the following occurs: a new instrument comes online, a major modification has been made to the instrument which has affected linearity, or at least once every year. Manufacturers may substitute the annual multipoint calibrations only if a daily instrument quality control chart is maintained which reveals changes in linearity. If the instrument response decreases to the point of being "out-of-control" and is not restored through repairs, however, a multipoint calibration must be performed to confirm linearity.

b. **Frequency of Limit of Detection Determinations**. When the methods were first developed and implemented, it was necessary to verify the limit of detection (LOD) and sensitivity of the instrumentation at regular intervals. However, subsequent testing has verified that

instrument LOD tends to remain stable for long periods of time, unless certain types of modifications are made to the instruments. Based on these test results, staff is proposing that LOD determinations be performed only if the following occurs: a new instrument comes on line, a major modification has been made to the instrument which has affected LOD or sensitivity, or at least once every year. Manufacturers may substitute the annual LOD calibrations only if a daily instrument quality control chart is maintained which would reveal changes in the LOD. If the instrument response decreases to the point of being "out-of-control" and is not restored through repairs, however, a multipoint calibration must be performed to confirm the LOD.

c. **LOD Calculation**. Staff is proposing a revision to the format of the LOD equation to reflect the units of the linear regression data. The standard deviation multiplier has been changed from a constant to a factor which is based on the number of replicate analyses performed. This will yield an LOD that is more representative of the laboratory's low-level measuring capabilities.

d. **Alternate Columns**. While the methods set forth a description of the columns used in ARB laboratories, staff is proposing that additional flexibility be given to individual laboratories which would allow the use of alternate columns as long as the column can be demonstrated to be equivalent or better with respect to precision, accuracy and resolution.

e. **Requirement for Compressed Air**. The modification proposed in this section adds a recommendation to use "ultra-zero air" rather than "zero air." Some laboratories may have difficulty meeting the LOD requirements of the test procedures because of possible hydrocarbon contamination. Using "ultra-zero air" would improve the signal-to-noise ratio in those instances.

f. **Use of Internal Standard**. Additional language is being proposed which would allow the use of an internal standard for calibration in methods 1001 and 1004. An internal standard is added to both the standards and samples to compensate for sample volume variability. This option is included to give laboratories greater flexibility and the potential to improve precision.

g. **List of Target Compounds**. Staff is proposing that the list which contains the compounds targeted by the NMOG methods be increased to more accurately reflect the compounds found in vehicles tested by the ARB. In addition, each compound's corresponding MIR value has been included for clarity. A complete list of the target compounds and their MIR values is contained in Appendix A.

h. **Modifications to Method 1001, Determination of Alcohols in Automotive Source Samples**

(1) In order to add flexibility to these methods, staff is proposing that in addition to allowing the use of deionized water, ASTM Type I purified water will also be allowed. CARB has found that both types of water are sufficiently pure for the analysis of alcohols.

(2) Section C.5.4. The modifications being proposed in this section would require the stock solution to be prepared gravimetrically, rather than volumetrically. This will ensure that the concentration is determined more accurately and eliminates the need to convert concentrations to mass units, thereby eliminating additional potential uncertainty.

(3) Section C.6.3. Previously, impingers were required to warm to room temperature prior to transfer to another container. However, a modification is being proposed that would require that the impingers be kept refrigerated to avoid sample loss due to degradation and/or evaporation.

i. **Modifications to Methods 1002 and 1003, Determination of Hydrocarbons in Automotive Source Samples**

(1) Section D.3.2. Staff is proposing that the requirement that CVS Bag No. 1 be analyzed in four hours is unnecessarily stringent. The original purpose of this requirement was to ensure that the compound 1,3-butadiene, which degrades very quickly, could be measured. However, subsequent analysis by staff has demonstrated that the level of 1,3-butadiene is very low and losses incurred between 4 and 8 hours (the new proposed analysis time) have minimal effect on the overall reactivity of the sample. Therefore, staff believes that extending the analysis time to eight hours is more reasonable.

(2) Section D.4.4 New language is being proposed which recommends the use of a wax precolumn when using the alumina PLOT column. Using a precolumn would not be required for analytical accuracy; however, its use would protect the PLOT column from moisture damage which could substantially reduce the life of the column.

(3) Section D.6.2. Language has been added which provides suggested operating parameters for the PLOT column.

(4) Section D.6.11; E.6.2.7. The modifications to these sections provide instructions for the reporting of coeluting compounds. This is necessary to ensure that all laboratories are using the same MIR values for all peaks.

(5) Section D.8.8; E.8.8 A new requirement is being proposed that each laboratory set a tolerance for crossover compounds in order to ensure better overall data quality.

(6) Section E.4.3 The reference to the PID was removed because it is not required for this analysis.

j. **Modifications to Method 1004 - Determination of Aldehyde and Ketone Compounds in Automotive Source Samples**

(1) Language is being proposed in several sections that would allow the use of either impingers or cartridges for the analysis of aldehydes and ketone compounds.

(2) Language is also being proposed which would allow operation of the HPLC in either a manual or automated mode.

(3) Section 3.3, 3.4, 6.6, 7.3, 7.4. The m-, p- and o- isomers of tolualdehyde coelute on some columns, while other types of columns are capable of separating these isomers. In order to ensure that the reported value for any of the isomers of tolualdehyde is consistent among laboratories, staff is proposing that all of the tolualdehyde isomers, whether separated or not, be counted as the primary isomer, m-tolualdehyde.

(4) Section F.4.1.5; F.6.6. The current method allows the use of a primary HPLC system to identify carbonyl compounds. Under this system, however, butyraldehyde and methyl ethyl ketone tend to coelute. In order to separate these compounds, staff is proposing the addition of a secondary system to ensure that all carbonyl compounds are properly identified. A laboratory may use the secondary system as the primary system, however, if they can demonstrate that all compounds are properly identified because formaldehyde and a non-carbonyl compound can coelute using this secondary system.

(5) Section F.5.4; F.6.3. While the ARB uses sulfuric acid in its laboratory, there are other laboratories which utilize perchloric acid. In order to reflect this, perchloric acid is being added to provide more flexibility to other laboratories.

(6) Section F.8.5. The proposed modification in this section allows a less stringent control range. The carbonyl analysis has an extremely low variability, making the three standard deviations from the mean requirement too stringent in some cases. Therefore, the requirement has been changed to be the greater of either 3 standard deviations or ± 10 percent of the mean value.

4. Part G:
   a. All sections: References to sections and methods have been clarified.
   b. All sections: The temperature and pressure calculation for the $Ivol_d$ and $Ivol_e$ equations were inadvertently transposed in the previous version. The correct equation is:

$$Ivol_{dm} * (293.26^{o}K / Itemp_d) * (P_B / 760 \text{ mm Hg})$$

All of the subsequent numerical changes in each section are due to this transposition.

c. Add CO_e and DF equations for Phase 2 gasoline. Update C:H ratio for LPG and CNG. See description in 2.b. above.

5. Appendix 1 - List of Target Compounds. The following is a complete list of the target compounds with the MIR values included.

LIST OF COMPOUNDS

CAS #	COMPOUND	MIR
	Alcohols	
00067-56-1	methanol	0.56
00064-17-5	ethanol	1.34
	Light End and Mid-Range Hydrocarbons (Listed in approximate elution order)	
00074-85-1	ethene	7.29
00074-86-2	ethyne	0.50
00074-84-0	ethane	0.25
00115-07-1	propene	9.40
00074-98-6	propane	0.48
00463-49-0	1,2-propadiene	10.89
00074-99-7	1-propyne	4.10
00075-28-5	2-methylpropane	1.21
00115-11-7	2-methylpropene	5.31
00106-98-9	1-butene	8.91
00106-99-0	1,3-butadiene	10.89
00106-97-8	n-butane	1.02
00624-64-6	trans-2-butene	9.94
00463-82-1	2,2-dimethylpropane	0.37
00107-00-6	1-butyne	9.24
00590-18-1	cis-2-butene	9.94
00563-45-1	3-methyl-1-butene	6.22
00078-78-4	2-methylbutane	1.38
00503-17-3	2-butyne	9.24
00109-67-1	1-pentene	6.22
00563-46-2	2-methyl-1-butene	4.90
00109-66-0	n-pentane	1.04
00078-79-5	2-~~mehtyl~~methyl-1,3-butadiene	9.08

CAS #	COMPOUND	MIR
00646-04-8	trans-2-pentene	8.80
00558-37-2	3,3-dimethyl-1-butene	4.42
00627-20-3	cis-2-pentene	8.80
00689-97-4	1-buten-3-yne	9.24
00513-35-9	2-methyl-2-butene	6.41
00542-92-7	1,3-cyclopentadiene	7.66
00075-83-2	2,2-dimethylbutane	0.82
00142-29-0	cyclopentene	7.66
00691-37-2	4-methyl-1-pentene	4.42
00760-20-3	3-methyl-1-pentene	4.42
00287-92-3	cyclopentane	2.38
00079-29-8	2,3-dimethylbutane	1.07
01634-04-4	1-methyl-tert-butyl-ether	0.62
00691-38-3	4-methyl-cis-2-pentene	6.69
00107-83-5	2-methylpentane	1.53
00674-76-0	4-methyl-trans-2-pentene	6.69
00096-14-0	3-methylpentane	1.52
00763-29-1	2-methyl-1-pentene	4.42
00592-41-6	1-hexene	4.42
00110-54-3	n-hexane	0.98
13269-52-8	trans-3-hexene	6.69
07642-09-3	cis-3-hexene	6.69
04050-45-7	trans-2-hexene	6.69
00616-12-6	3-methyl-trans-2-pentene	6.69
00625-27-4	2-methyl-2-pentene	6.69
01120-62-3	3-methylcyclopentene	5.65
07688-21-3	cis-2-hexene	6.69
00637-92-3	1-ethyl-tert-butyl-ether	1.98
00929-62-3	3-methyl-cis-2-pentene	6.69
00590-35-2	2,2-dimethylhexanepentane	1.40
00096-37-7	methylcyclopentane	2.82
00108-08-7	2,4-dimethylpentane	1.78
00464-06-2	2,2,3-trimethylbutane	1.32
07385-78-6	3,4-dimethyl-1-pentene	3.48
00693-89-0	1-methylcyclopentene	7.66
00071-43-2	benzene	0.42
03404-61-3	3-methyl-1-hexene	3.48
00562-049-2	3,3-dimethylpentane	0.71
00110-82-7	cyclohexane	1.28
00591-76-4	2-methylhexane	1.08

CAS #	COMPOUND	MIR
00565-59-3	2,3-dimethylpentane	1.51
00110-83-8	cyclohexene	5.67
00589-34-4	3-methylhexane	1.40
01759-58-6	trans-1,3-dimethylcyclopentane	2.55
02532-58-3	cis-1,3-dimethylcyclopentane	2.55
00617-78-7	3-ethylpentane	1.40
00822-50-4	trans-1,2-dimethylcyclopentane	1.85
00592-76-7	1-heptene	3.48
00540-84-1	2,2,4-trimethylpentane	0.93
14686-14-7	trans-3-heptene	5.53
00142-82-5	n-heptane	0.81
02738-19-4	2-methyl-2-hexene	5.53
03899-36-3	3-methyl-trans-3-hexene	5.53
14686-13-6	trans-2-heptene	5.53
00816-79-5	3-ethyl-~~cis~~-2-pentene	5.53
00107-39-1	2,4,4-trimethyl-1-pentene	2.69
10574-37-5	2,3-dimethyl-2-pentene	5.53
06443-92-1	cis-2-heptene	5.53
00108-87-2	methylcyclohexane	1.85
00590-73-8	2,2-dimethylhexane	1.20
00107-40-4	2,4,4-trimethyl-2-pentene	5.29
01640-89-7	ethylcyclopentane	2.31
00592-13-2	2,5-dimethylhexane	1.63
00589-43-5	2,4-dimethylhexane	1.50
02815-58-9	1,2,4-trimethylcyclopentane	1.94
00563-16-6	3,3-dimethylhexane	1.20
00565-75-3	2,3,4-trimethylpentane	1.60
00560-21-4	2,3,3-trimethylpentane	1.20
00108-88-3	toluene	2.73
00584-94-1	2,3-dimethylhexane	1.32
00592-27-8	2-methylheptane	0.96
00589-53-7	4-methylheptane	1.20
00589-81-1	3-methylheptane	0.99
15890-40-1	~~1-cis-2-trans~~(1a,2a,3b)-1,2,3-trimethylcyclopentane	1.94
00638-04-0	cis-1,3-dimethylcyclohexane	1.94
02207-04-7	trans-1,4-dimethylcyclohexane	1.94
03522-94-9	2,2,5-trimethylhexane	0.97
02613-65-2	trans-1-methyl-3-ethylcyclopentane	1.94
16747-50-5	cis-1-methyl-3-ethylcyclopentane	1.94
00111-66-0	1-octene	2.69

CAS #	COMPOUND	MIR
14850-23-8	trans-4-octene	5.29
00111-65-9	n-octane	0.61
13389-42-9	trans-2-octene	5.29
02207-03-6	trans-1,3-dimethylcyclohexane	1.94
07642-04-8	cis-2-octene	5.29
01069-53-0	2,3,5-trimethylhexane	1.14
02213-23-2	2,4-dimethylheptane	1.34
02207-01-4	cis-1,2-dimethylcyclohexane	1.94
01072-05-5	2,6-dimethylheptane	1.14
01678-91-7	ethylcyclohexane	1.94
00926-82-9	3,5-dimethylheptane	1.14
00100-41-4	ethylbenzene	2.70
03074-71-32	2,3-dimethylheptane	1.14
00108-38-3	m-&p-xylene	7.64
02216-34-4	4-methyloctane	1.14
03221-61-2	2-methyloctane	1.14
02216-33-3	3-methyloctane	1.14
00100-42-5	styrene (ethenylbenzene)	2.22
00095-47-6	o-xylene	6.46
00124-11-8	1-nonene	2.23
00111-84-2	n-nonane	0.54
00098-82-8	(1-methylethyl)benzene	2.24
15869-87-1	2,2-dimethyloctane	1.01
04032-94-4	2,4-dimethyloctane	1.01
02051-30-1	2,6-dimethyloctane	1.01
00103-65-1	n-propylbenzene	2.12
00620-14-4	1-methyl-3-ethylbenzene	7.20
006220-96-8	1-methyl-4-ethylbenzene	7.20
00108-67-8	1,3,5-trimethylbenzene	10.12
00611-14-3	1-methyl-2-ethylbenzene	7.20
00095-63-6	1,2,4-trimethylbenzene	8.83
00124-18-5	n-decane	0.47
00538-93-2	(2-methylpropyl)benzene	1.87
00135-98-8	(1-methylpropyl)benzene	1.89
00535-77-3	1-methyl-3-(1-methylethyl)benzene	6.45
00572-6-73-8	1,2,3-trimethylbenzene	8.85
00099-87-6	1-methyl-4-(1-methylethyl)benzene	6.45
00496-11-7	2,3-dihydroindene (indan)	1.06
00527-84-4	1-methyl-2-(1-methylethyl)benzene	6.45
00141-93-5	1,3-diethylbenzene	6.45

CAS #	COMPOUND	MIR
00105-05-5	1,4-diethylbenzene	6.45
01074-43-7	1-methyl-3-n-propylbenzene	6.45
01074-55-1	1-methyl-4-n-propylbenzene	6.45
00135-01-3	1,2-diethylbenzene	6.45
01074-17-5	1-methyl-2-n-propylbenzene	6.45
01758-88-9	1,4-dimethyl-2-ethylbenzene	9.07
00874-41-9	1,3-dimethyl-4-ethylbenzene	9.07
00934-80-5	1,2-dimethyl-4-ethylbenzene	9.07
02870-040-4	1,3-dimethyl-2-ethylbenzene	9.07
01120-21-4	n-undecane (hendecane)	0.42
00933-98-2	1,2-dimethyl-3-ethylbenzene	9.07
00095-93-2	1,2,4,5-tetramethylbenzene	9.07
03968-85-2	(2-methylbutyl)benzene	
01595-11-5	1-methyl-2-n-butylbenzene	5.84
00527-53-7	1,2,3,5-tetramethylbenzene	9.07
27138-21-201074-92-6	1-(1,1-dimethylethyl)-2-methylbenzene	5.84
00488-23-3	1,2,3,4-tetramethylbenzene	9.07
00538-68-1	n-pentylbenzene	1.70
00098-19-1	1-(1,1-dimethylethyl)-3,5-DMbenzene	7.50
00091-20-3	naphthalene	1.18
00112-40-3	n-dodecane	0.38

Carbonyl Compounds

00050-00-0	formaldehyde	7.15
00075-07-0	acetaldehyde	5.52
00107-02-8	acrolein	6.77
00067-64-1	acetone	0.56
00123-38-6	propionaldehyde	6.53
00123-72-8	butyraldehyde	5.26
00066-25-1	hexanaldehyde	3.79
00100-52-7	benzaldehyde	-0.55
00078-93-3	methyl ethyl ketone (2-butanone)	1.18
00078-85-3	methacrolein	6.77
04170-30-3	crotonaldehyde	5.42
00110-62-3	valeraldehyde	4.41
00620-23-5	m-tolualdehyde	-0.55

List of ~~Light End and Mid-Range Hydrocarbons~~ Compounds
(Listed by CAS number)

00050-00-0	formaldehyde
00064-17-5	ethanol
00066-25-1	hexanaldehyde
00067-56-1	methanol
00067-64-1	acetone
00071-43-2	benzene
00074-84-0	~~ethyane~~ ethane
00074-85-1	ethene
00074-86-2	ethyne
00074-98-6	propane
00074-99-7	1-propyne
00075-07-0	acetaldehyde
00075-28-5	2-methylpropane
00075-83-2	2,2-dimethylbutane
00078-78-4	2-methylbutane
00078-79-5	2-methyl-1,3-butadiene
00078-85-3	methacrolein
00078-93-3	methyl ethyl ketone (2-butanone)
00079-29-8	2,3-dimethylbutane
00091-20-3	naphthalene
00095-47-6	o-xylene
00095-63-6	1,2,4-trimethylbenzene
00095-93-2	1,2,4,5-tetramethylbenzene
00096-14-0	3-methylpentane
00096-37-7	methylcyclopentane
00098-19-1	1-(1,1-dimethylethyl)-3,5-dimethylbenzene
00098-82-8	(1-methylethyl)benzene
00099-87-6	1-methyl-4-(1-methylethyl)benzene
00100-41-4	ethylbenzene
00100-42-5	stryrene
00100-52-7	benzaldehyde
00103-65-1	n-propylbenzene
00105-05-5	1,4-diethylbenzene
00106-97-8	n-butane
00106-98-9	1-butene
00106-99-0	1,3-butadiene
00107-00-6	1-butyne
00107-02-8	acrolein
00107-39-1	2,4,4-trimethyl-1-pentene

00107-40-4	2,4,4-trimethyl-2-pentene
00107-83-5	2-methylpentane
00108-08-7	2,4-dimethylpentane
00108-38-3	m&p-xylene
00108-67-8	1,3,5-trimethylbenzene
00108-87-2	methylcyclohexane
00108-88-3	toluene
00110-62-3	valeraldehyde
00109-66-0	n-pentane
00109-67-1	1-pentene
00110-54-3	n-hexane
00110-82-7	cyclohexane
00110-83-8	cyclohexene
00111-65-9	n-octane
00111-66-0	1-octene
00111-84-2	n-nonane
00112-40-3	n-dodecane
00115-07-1	propene
00115-11-7	2-methylpropene
00123-38-6	propionaldehyde
00123-72-8	butyraldehyde
00124-11-8	1-nonene
00124-18-5	n-decane
00135-01-3	1,2-diethylbenzene
00135-98-8	(1-methylpropyl)benzene
00141-93-5	1,3-diethylbenzene
00142-29-0	cyclopentene
00142-82-5	n-heptane
00287-92-3	cyclopentane
00463-49-0	1,2-propadiene
00463-82-1	2,2-dimethylpropane
00464-06-2	2,2,3-trimethylbutane
00488-23-3	1,2,3,4-tetramethylbenzene
00496-11-7	2,3-dihydroindene (indan)
00503-17-3	2-butyne
00513-35-9	2-methyl-2-butene
00526-73-8	1,2,3-trimethylbenzene
00527-53-7	1,2,3,5-tetramethylbenzene
00527-84-4	1-methyl-2-(1-methylethyl)benzene
00535-77-3	1-methyl-3-(1-methylethyl)benzene
00538-68-1	n-pentylbenzene
00538-93-2	(2-methylpropyl)benzene
00540-84-1	2,2,4-trimethylpentane

00542-92-7	1,3-cyclopentadiene
00558-37-2	3,3-dimethyl-1-butene
00560-21-4	2,3,3-trimethylpentane
00562-49-2	3,3-dimethylpentane
00563-16-6	3,3-dimethylhexane
00563-45-1	3-methyl-1-butene
00563-46-2	2-methyl-1-butene
00565-59-3	2,3-dimethylpentane
00565-75-3	2,3,4-trimethylpentane
00584-94-1	2,3-dimethylhexane
00589-34-4	3-methylhexane
00589-43-5	2,4-dimethylhexane
00589-53-7	4-methylheptane
00589-81-1	3-methylheptane
00590-18-1	cis-2-butene
00590-35-2	2,2-dimethyl~~hexane~~ pentane
00590-73-8	2,2-dimethylhexane
00591-76-4	2-methylhexane
00592-13-2	2,5-dimethylhexane
00592-27-8	2-methylheptane
00592-41-6	1-hexene
00592-76-7	1-heptene
00611-14-3	1-methyl-2-ethylbenzene
00616-12-6	3-methyl-trans-2-pentene
00617-78-7	3-ethylpentane
00620-14-4	1-methyl-3-ethylbenzene
00620-23-5	m-tolualdehyde
00622-96-8	1-methyl-4-ethylbenzene
00624-64-6	trans-2-butene
00625-27-4	2-methyl-2-pentene
00627-20-3	cis-2-pentene
00637-92-3	1-ethyl-tert-butyl-ether
00638-04-0	cis-1,3-dimethylcyclohexane
00646-04-8	trans-2-pentene
00674-76-0	4-methyl-trans-2-pentene
00689-97-4	1-buten-3-yne
00691-37-2	4-methyl-1-pentene
00691-38-3	4-methyl-cis-2-pentene
00693-89-0	1-methylcyclopentene
00760-20-3	3-methyl-1-pentene
00763-29-1	2-methyl-1-pentene
00816-79-5	3-ethyl-~~cis~~-2-pentene
00822-50-4	trans-1,2-dimethylcyclopentane

00874-41-9	1,3-dimethyl-4-ethylbenzene
00929-62-3	3-methyl-cis-2-pentene
00926-82-9	3,5-dimethylheptane
00933-98-2	1,2-dimethyl-3-ethylbenzene
00934-80-5	1,2-dimethyl-4-ethylbenzene
01069-53-0	2,3,5-trimethylhexane
01072-05-5	2,6-dimethylheptane
01074-17-5	1-methyl-2-n-propylbenzene
01074-43-7	1-methyl-3-n-propylbenzene
01074-55-1	1-methyl-4-n-propylbenzene
01074-92-627138-21-2	1-(1,1-dimethylethyl)-2-methylbenzene
01120-21-4	n-undecane
01120-62-3	3-methylcyclopentene
01595-11-5	1-methyl-2-n-butylbenzene
01634-04-4	1-methyl-tert-butyl-ether
01640-89-7	ethylcyclopentane
01678-91-7	ethylcyclohexane
1001758-88-9	1,4-dimethyl-2-ethylbenzene
01759-58-6	trans-1,3-dimethylcyclopentane
02051-30-1	2,6-dimethyloctane
02207-01-4	cis-1,2-dimethylcyclohexane
02207-03-6	trans-1,3-dimethylcyclohexane
02207-04-7	trans-1,4-dimethylcyclohexane
02213-23-2	2,4-dimethylheptane
02216-33-3	3-methyloctane
02216-34-4	4-methyloctane
02532-58-3	coscis-1,3-dimethylcyclopentane
02613-65-2	trans-1-methyl-3-ethylcyclopentane
02738-19-4	2-methyl-2-hexene
02815-58-9	1,2,4-trimethylcyclopentane
02870-04-4	1,3-dimethyl-2-ethylbenzene
03074-71-3	2,3-dimethylheptane
03221-61-2	2-methyloctane
03404-61-3	3-methyl-1-hexene
03522-94-9	2,2,5-trimethylhexane
03899-36-3	3-methyl-trans-3-hexene
03968-85-2	(2-methylbutyl)benzene
04032-94-4	2,4-dimethyloctane
04050-45-7	trans-2-hexene
04170-30-3	crotonaldehyde
06443-92-1	cis-2-heptene
07385-78-6	3,4-dimethyl-1-pentene
07642-04-8	cis-2-octene

07642-09-3	cis-3-hexene
07688-21-3	cis-2-hexene
10574-37-5	2,3-dimethyl-2-pentene
13269-52-8	trans-3-hexene
13389-42-9	trans-2-octene
14686-13-6	trans-2-heptene
14686-14-7	trans-3-heptene
14850-23-8	trans-4-octene
15869-87-1	2,2-dimethyloctane
15890-40-1	~~1-cis,2-trans,~~ (1a,2a,3b)-1,2,3-trimethylcyclopentane
16747-50-5	cis-1-methyl-3-ethyl-cyclopentane

F. California Assembly-Line Test Procedures for 1996 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles

Since the Assembly-Line Test Procedures have not been substantially revised since 1983, staff is proposing that a new document be created which applies to 1998 and subsequent model passenger cars, light-duty truck and medium-duty vehicles. The new document is not substantially different than the previous version; however, it has been updated to reflect current practices and new testing requirements (such as those for on-board diagnostics and updating the reporting requirements). In order to more clearly describe the differences from the previous Assembly-Line Test Procedures (the 1983 version), regulatory modifications are shown in underline to indicate new text and in ~~strikeout~~ to indicate deleted text. In addition, text has been added to clarify existing procedures. The following summarizes the proposed modifications.

1. **Section C.1**. In order to ensure that representative vehicles are chosen for assembly line testing, staff is proposing that a manufacturer's selection procedure be approved by the ARB prior to the start of production. The existing regulation requires that a plan be submitted but does not clearly provide that the plan needs to be approved. For a manufacturer's plan to be approved, it must ensure that the vehicle selection pool includes all vehicles legal for sale in California, it must utilize a random process for individual vehicle selection, and the status of the vehicles chosen for emission testing must not be known to those assembling the vehicles.

2. **Section C.2**. Under current procedures, a manufacturer may accumulate mileage on test vehicles prior to testing. However, the current procedure does not specify what constitutes acceptable mileage accumulation. As increasing numbers of low-emission vehicles are certified, mileage accumulation may become more important. For this reason, a modification is being proposed that requires a manufacturer to disclose its specific mileage accumulation plan for review and approval by the Executive Officer. The following is the proposed modification:

"An acceptable plan for accelerated mileage accumulation/engine break-in schedules (high engine rpm for an extended period of time or other abnormal driving conditions) and special preparation (e.g., disabling the traction control) for an engine family or subgroup must be submitted to the Executive Officer for approval prior to the planned implementation. The plan will be deemed acceptable if the manufacturer demonstrates that the plan does not alter the emission control effectiveness of a vehicle under conditions which may reasonably be expected to be encountered in normal operation and use."

3. **Section C.2.(c)(1)(i), (ii) and (iii**) contain a reference to a method specified in subsection 4.c.iii of the California Evaporative Emissions Standards and Test Procedures for 1978 and Subsequent Model Motor Vehicles. In order to provide further flexibility, staff is proposing that manufacturers be allowed to use a 50/50 mixture by volume of butane and nitrogen instead of the fuel used in normal operation. Using this mixture produces a greater heel on the canister than with fuel vapors and is also safer than using fuel vapors.

4. **Section C.2.(c)(1)(iv)**. Another option is being proposed which allows the use of a surrogate canister because in some vehicle models it is impossible to access the canister without removing other components. The proposed language is as follows:

> "As an alternative to loading the on-board canister in option (iii), a surrogate canister may be used as in option (ii); however, the surrogate canister may not be used more than once, and the loading procedure shall be as specified in section 4.g.iii.C and 4.g.iii.D. except that prior to the canister loading, each canister shall be cycled no less than two times utilizing the fuel used in normal operation, or utilizing a 50/50 mixture by volume of butane and nitrogen, in order to place a heel on each canister."

5. **Sections C.2(d) - (g) and C.4**. The language in these subparagraphs is essentially the same as in the previous version; however, the text has been reorganized to provide clarity. In order to incorporate the second generation on-board diagnostic (OBD II) system which is required on 1996 and later model cars and trucks, staff is proposing the following substantive modifications. If the malfunction indicator light (MIL) is illuminated during testing, manufacturers are permitted to stop the test and perform any repairs necessary to extinguish the MIL using the manufacturer's published service procedures. If the MIL illuminates on two or more vehicles, an engineering evaluation of such occurrences must be submitted to the ARB.

6. **Section C.5.(c)**. Under federal regulations, vehicles certifying to organic material hydrocarbon equivalent (OMHCE) standards are now required to certify to the organic material non-methane hydrocarbon equivalent (OMNMHCE) standards beginning 1994. Therefore, staff is proposing deletion of all references to OMHCE.

7. **Section 7**. Reports. The proposed modifications in this section are to ensure that the reports received by the ARB are complete and contain the necessary information for an adequate evaluation of the quality audit data. To standardize the report format and to reduce costs for both the manufacturer and for the ARB, staff is proposing that manufacturers be required to submit test data and quarterly evaluation data in an electronic format as well as including a summary in hard copy of the quarterly data. Most of the data being requested is already reported by manufacturers; the language being proposed here is to clarify our requirements.

8. **Section 8**. Retention of Data. The ARB is proposing that manufacturers retain their records for three years after the start of production. This would ensure that ARB staff would have adequate documentation of any problems that may occur during assembly-line testing.

G. California New Vehicle Compliance Test Procedure

This test procedure has not been updated since May 1979. In order to bring the testing procedure more in line with current practices, the following modifications are being proposed.

1. Zero-emission vehicles and medium-duty vehicles certified to the optional heavy-duty engine standards have been exempted from these test procedures.

2. These test procedures have been updated to include new on-board diagnostic requirements. The proposed requirements are identical to those being proposed in the Assembly Line Test Procedures.

4. In order to evaluate vehicles which are certified to 100,000 or 120,000 mile exhaust emission standards, staff is proposing that the emission results be projected to 100,000 or 120,000 miles. The proposed language is:

".... <u>For evaluation, all emissions shall be projected to 50,000 or 100,000 miles (where applicable) for light-duty vehicles and to 50,000 or 120,000 miles (where applicable) for medium-duty vehicles, using the certification deterioration factors for the engine family or subgroup</u>."

5. Under current procedures, a manufacturer may accumulate mileage on test vehicles prior to testing. The current procedure implies but does not specify that Executive Officer approval is necessary for mileage accumulation prior to testing. For this reason, a modification is being proposed that requires a manufacturer to disclose its specific mileage accumulation schedule prior to testing for review and approval by the Executive Officer. The following is the proposed modification:

"~~Mileage accumulation before testing~~ An approved mileage accumulation schedule may be applied to ~~performed on~~ test vehicles to the same extent as mileage accumulation is performed on assembly-line quality audit test vehicles."

H. California Motor Vehicle Emission Control Label Specifications

1. **Section 3.(a)(iv) and 3.(b)**. Bar-coded labels are intended to aid the smog check process by allowing accurate identification of a vehicle and its emission controls. However, since motorcycles are not subject to the smog check process, they should be exempt from this requirement. Likewise, motorcycles are exempt from on-board diagnostic requirements and should be exempted. Staff proposes to amend the regulatory language as follows:

"3.(a)(iv) ...on-board diagnostic system. Motorcycles and ZEVs are exempt from these requirements."

"3.(b) "The machine-readable VEC bar code ... shall be applicable to 1990 and subsequent model-year vehicles and engines except ~~ZEVs~~, motorcycles and diesel-fueled vehicles and diesel engines not subject to inspection and maintenance requirements. ..."

2. **Section 3.(a)(v)**. Reference is made to SAE Recommended Practice J1930, dated June 1988. This practice has since been updated (September, 1991) and several abbreviations have been updated as well. Therefore, the date has been changed to reflect the update and the following abbreviations have been changed as well:

~~CIS~~ CFI	-	Continuous Fuel Injection
~~MPI~~ MFI	-	Multipoint Electronic Fuel Injection
~~SMPI~~ SFI	-	Sequential Multipoint Electronic Fuel Injection

3. **Section 3(b)**. In response to the requirements of Senate Bill 2050, staff is proposing that a ninth character be added to the VEC bar code which will provide information concerning the emission category to which the vehicle was certified. For example, the ninth character of the VEC bar code on a TLEV would be A. ZEVs, which were previously exempt from the bar code requirement, will now be included because the ninth character will apply to them. It is proposed that the first eight characters of the ZEV bar code label be ZZZZZZZZ. This label will also be applicable to those ZEVs certified as HEVs because their fuel-fired heater operates above 40ºF.

The following characters are being proposed:

The ninth character of the VEC bar-code label is the code for the emission standard to which the vehicle was certified. This character shall apply to all 1998 and subsequent model passenger cars, light-duty trucks, medium-duty vehicles and heavy-duty engines. Coding for this character is as follows:

TLEV	A
LEV	B
ULEV	C
ZEV	Z
TLEV HEV	D
LEV HEV	E
ULEV HEV	F
SLEV	G
Federally-Certified Vehicles	H
Title 13, CCR, Section 1960.1(f)(2) Vehicles	L
Title 13, CCR, Section 1956.8(a) Vehicles	M
Title 13, CCR, Section 1956.8(c) Vehicles	N

The ninth character shall not be necessary if the sixth character of the VEC bar-code label correctly identifies the California emission standard to which the vehicle is certified.

4. **Section 2(b) and Section 3.5**. Pursuant to the requirements of Senate Bill 2050, a window label is being proposed that specifies smog indices for new 1995 and subsequent model year light-duty vehicles delivered for sale in California. The smog index (SI) indicates the relative level of pollutants emitted by the vehicles. For example, the lower the SI, the lower the vehicle's emissions. The amendment proposes that the Executive Officer would determine the smog index based on the tailpipe and evaporative emissions of ozone precursor chemicals. A complete description of the language being proposed in this amendment is contained in the emission control label specifications.